

McCORMICK TURBINES



FROM
BOSTON OFFICE
S. Morgan Smith Co.
176 FEDERAL ST.

S. MORGAN SMITH CO.
YORK, PA.

Bulletin 110

McCORMICK TURBINES

MANUFACTURED BY
S. MORGAN SMITH CO.
YORK, PA., U. S. A.

BRANCH OFFICES

BOSTON
176 Federal St.

CHICAGO
76 West Monroe St.

MONTREAL
405 Power Bldg.

Cable Address
"Success"

Codes: ABC 4th and 5th Edition
Lieber's
Western Union
Bentley's



THE WORLD'S LARGEST HYDRAULIC TURBINE WORKS

S. MORGAN SMITH COMPANY, YORK, PA.

Introductory.

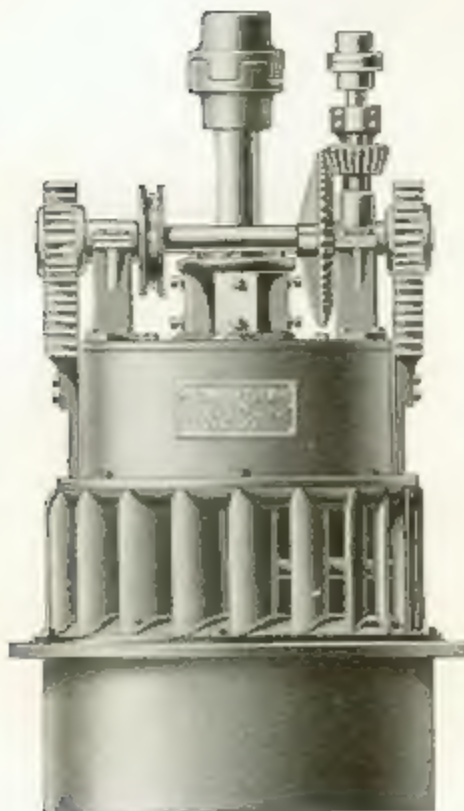
OUR purpose in publishing this Bulletin is to be able to present to our many customers, who are using the well known McCormick cylinder gate turbine, a set of tables giving the power, speed and water consumption of same, and also to meet the requirements where we quote on small turbines of this type to prospective customers who prefer a cylinder gate wheel.

This Bulletin does not represent the complete line of turbines built by this Company, as we continue to build the New Success turbine and also the Smith turbine. We have, also, designed and built many other types of turbines, some of which develop much greater capacity and higher speed than either the McCormick, New Success or Smith turbines.

Those contemplating the purchase of turbine water wheels and accessories will find it to their interest to communicate with this Company as our designing and estimating departments are at all times at the service of our prospective customers.

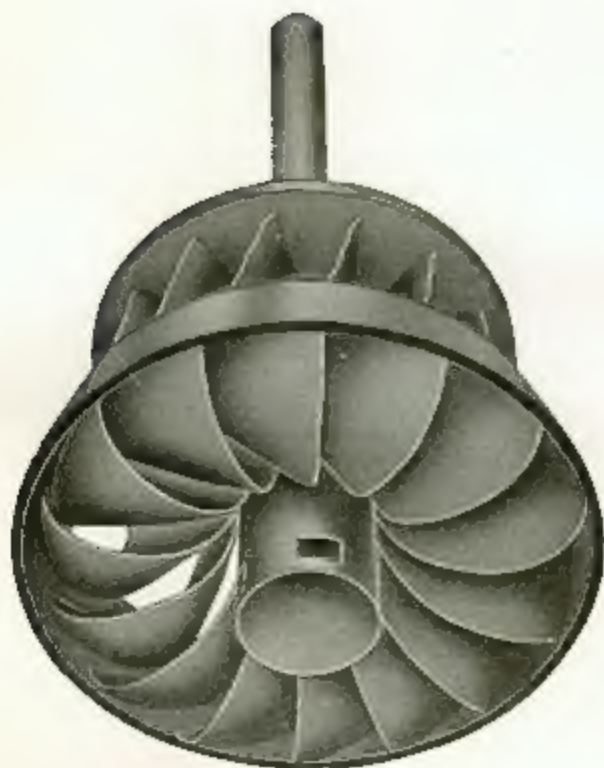
S. MORGAN SMITH COMPANY,
YORK, P.A.

"The McCormick"



Engraving No. 401.

Represents the standard vertical McCormick Turbine. All wheels 24" and smaller will be shipped complete as shown. Larger sizes will be shipped in sections for convenience in handling.



Engraving No. 402.

Represents the standard McCormick runner with its shaft and cast iron step shoe. These standard runners are made of cast iron. Attention is called to the openings for water for cooling the concave surface of the step shoe that turns on the lignum vitae step.

Directions for the Construction of Head and Tail Races

THE HEAD RACE

In constructing the canal or head race, a very frequent error is committed by failing to give it sufficient capacity. It should be wide and deep, and especially where the race is of considerable length, and a large quantity of water is to pass through it. As a general rule, the water should not flow faster than from 60 to 120 feet per minute. Where there is a long race, after the turbine has been running three or four hours the head frequently draws down from one to three feet. The effect of this is the same as if the dam had been lowered an equal distance—resulting in a loss of power, which would have been prevented by making the race as wide and deep as it should be.

When the water is to be conveyed through pipes to the turbines operating under low heads, the receiving ends of the pipes should be well submerged so as prevent any possibility of their drawing air. The diameter of the pipe to be recommended varies according to the quantity of water, length and contour of the pipe, head of water acting on the turbine and the head loss permissible due to friction.

THE TAIL RACE

This should be wide and deep, and the level of the bottom of the wheel pit should be carried from ten to forty feet below the end of flume, depending upon the amount of water discharged by the turbine, and if possible it should be carried out to the bed of the stream, as no tail race for even small turbines should have less than two feet of dead water in it before the turbines are put in motion, and where large turbines (using considerable water) are to be used, the tail race should have three or four feet of dead water in its entire length. By having the tail race thus constructed, as soon as the water is discharged from the turbines, it will push out or displace the dead water in the race, thus preventing a loss of head. For instance, to be more explicit, suppose the bottom of tail race is on a level with the water in main stream into which the tail

race discharges, when the turbines are started the water in tail race would rise in proportion to the width of the race and the quantity of water flowing therein, and reduce the working head in proportion; while if the race were as first above stated, the water from the turbines would displace the dead water without rising above the water in the main stream, thus utilizing the full amount of head. From one to three feet of working head is often lost for want of proper depth and width of tail race.

WHEEL PIT

Here is where mill owners and millwrights, in putting in turbines are more liable to err than elsewhere. Whether under high or low heads, the pit should be deep and wide. There is no case where this is more important than where a large turbine is run under a low head; as under these circumstances it is not desirable to lose any head whatever. A pit of insufficient size causes the water to react upon the turbine, and an additional loss of power is also caused by the fact that a portion of the head is consumed in forcing the water out of the pit when there is not sufficient outlet. As a rule, the depth of the pit should not be less than the diameter of the lower end of the draft tube.

Water has but 100 per cent. in it, and a turbine that takes out from 80 to 90 of that per cent. leaves but little force in it. To expect that the water coming through our turbines will have power to wash the sand and gravel out of their own pit, is to expect what will not be realized. Hence in putting in turbines, do not calculate upon the water in the wheel pit to do any work. If you find it foaming and dashing in the pit, then rest assured that the pit is either too shallow or too narrow, or both.

SETTING TURBINES ABOVE TAIL WATER

Sometimes in adapting turbines to high and even low heads, it becomes necessary to set the turbines some distance above the tail water and conduct the water from them through draft tubes. Better results may be obtained when turbines are set in this manner than if placed close to the tail water, provided the draft tubes are air tight and their discharge ends properly submerged. In all cases when draft tubes are used, they should be made of steel or concrete.

Directions for Setting Wheels

In setting turbines of our manufacture in a wooden penstock, the first thing to do is to see that the floor of the flume is level. Generally a ring made of soft wood is placed on the floor around the hole, on which the draft tube flange of the wheel, which is faced off, is set. It is very important that the flume be built on good foundations so as not to settle when the water is let in; a very good plan, and especially where large turbines are to be set, is to put four posts or iron columns under the timbers around the hole in the floor through which the draft tube passes.

The step and all bearings of the turbines are carefully adjusted before leaving the shops.

When turbines are shipped "knocked down," the draft tube should always be set in position first, then the runner or wheel proper placed on the step, then set the case and so on until all parts are together. When the step is properly adjusted, there will be a space between the top of the band of the runner and the bottom or inner edge of the bottom plate of $\frac{3}{16}$ ". When the turbines are not to be run for some time, the step shoes should be well covered with tallow to prevent rusting.

WARRANTY

Turbines installed in accordance with our instructions and operated at speeds recommended by us, for each installation, failing to give the power guaranteed by us, can be returned if not broken, to the station to which they were shipped any time within thirty days, and the money received for such wheels will be refunded. If purchaser finds it impossible to put the turbine in and give it a trial within the thirty days allotted, and wants more time it will be granted on application, not exceeding in all sixty days from date of shipment.

S. MORGAN SMITH COMPANY.

Test and Tables of Turbines

The tables of the turbines of our manufacture are based on actual tests made in the Holyoke Testing Flume—the *only reliable testing flume in the country*. Both right and left hand turbines have been tested and brought to over 80 per cent. efficiency. Although our tables are only based on 80 per cent. useful effect from the water used, all of the turbines have exceeded 80 per cent. in the tests, *some sizes having given over 90 per cent. at less than full gate with very high average from half to full gate*.

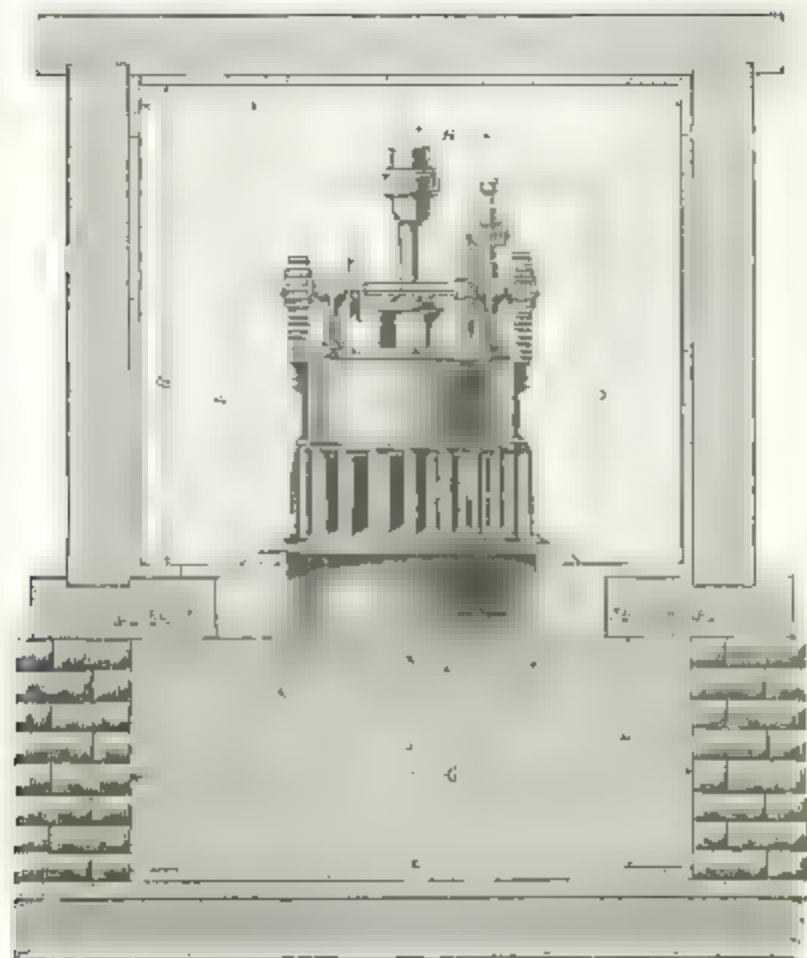
When comparing the tables of our turbines with those of other manufacturers, satisfy yourself that the tables of those turbines are reliably made. Many turbine builders have tabled their turbines at 80 or even 90 per cent., when if the truth were known, their turbines in actual test would not exceed 60 to 70 per cent.

Before purchasing a turbine be assured that the tables of the particular size turbine you require are based on actual tests made in the new flume of the Holyoke Water Power Company. Water powers are becoming more valuable each year, and the owners of water powers cannot afford to run turbines which sacrifice water and give but little power.

The following rule will enable you to determine the percentage at which any turbine is tabled.

RULE

Multiply the cubic feet of water by $62\frac{1}{2}$, which is the weight of one cubic foot of water; multiply the product by the head, which will give the foot pounds; divide that product by 33,000, which gives the full horse-power of the water; divide the horse-power claimed by the full horse-power of the water, and the result will be the percentage at which the turbine is tabled.



Engraving No 403

DIMENSIONS of TURBINES and PENSTOCKS IN INCHES

Let standard dimensions correspond to first letters in English alphabet

D 200 1/2	A	B	C	D	E	F	G	H	K
1	36	42	48	54	60	66	72 1/2	78 1/2	84
2	42	48	54	60	66	72	78 1/2	84 1/2	90
3	48	54	60	66	72	78	84 1/2	90 1/2	96
4	54	60	66	72	78	84	90 1/2	96 1/2	102
5	60	66	72	78	84	90	96 1/2	102 1/2	108
6	66	72	78	84	90	96	102 1/2	108 1/2	114
7	72	78	84	90	96	102	108 1/2	114 1/2	120
8	78	84	90	96	102	108	114 1/2	120 1/2	126
9	84	90	96	102	108	114	120 1/2	126 1/2	132
10	90	96	102	108	114	120	126 1/2	132 1/2	138
11	96	102	108	114	120	126	132 1/2	138 1/2	144
12	102	108	114	120	126	132	138 1/2	144 1/2	150
13	108	114	120	126	132	138	144 1/2	150 1/2	156
14	114	120	126	132	138	144	150 1/2	156 1/2	162
15	120	126	132	138	144	150	156 1/2	162 1/2	168
16	126	132	138	144	150	156	162 1/2	168 1/2	174
17	132	138	144	150	156	162	168 1/2	174 1/2	180
18	138	144	150	156	162	168	174 1/2	180 1/2	186
19	144	150	156	162	168	174	180 1/2	186 1/2	192
20	150	156	162	168	174	180	186 1/2	192 1/2	198
21	156	162	168	174	180	186	192 1/2	198 1/2	204
22	162	168	174	180	186	192	198 1/2	204 1/2	210
23	168	174	180	186	192	198	204 1/2	210 1/2	216
24	174	180	186	192	198	204	210 1/2	216 1/2	222
25	180	186	192	198	204	210	216 1/2	222 1/2	228
26	186	192	198	204	210	216	222 1/2	228 1/2	234
27	192	198	204	210	216	222	228 1/2	234 1/2	240
28	198	204	210	216	222	228	234 1/2	240 1/2	246
29	204	210	216	222	228	234	240 1/2	246 1/2	252
30	210	216	222	228	234	240	246 1/2	252 1/2	258
31	216	222	228	234	240	246	252 1/2	258 1/2	264
32	222	228	234	240	246	252	258 1/2	264 1/2	270
33	228	234	240	246	252	258	264 1/2	270 1/2	276
34	234	240	246	252	258	264	270 1/2	276 1/2	282
35	240	246	252	258	264	270	276 1/2	282 1/2	288
36	246	252	258	264	270	276	282 1/2	288 1/2	294
37	252	258	264	270	276	282	288 1/2	294 1/2	300
38	258	264	270	276	282	288	294 1/2	300 1/2	306
39	264	270	276	282	288	294	300 1/2	306 1/2	312
40	270	276	282	288	294	300	306 1/2	312 1/2	318
41	276	282	288	294	300	306	312 1/2	318 1/2	324
42	282	288	294	300	306	312	318 1/2	324 1/2	330
43	288	294	300	306	312	318	324 1/2	330 1/2	336
44	294	300	306	312	318	324	330 1/2	336 1/2	342
45	300	306	312	318	324	330	336 1/2	342 1/2	348
46	306	312	318	324	330	336	342 1/2	348 1/2	354
47	312	318	324	330	336	342	348 1/2	354 1/2	360
48	318	324	330	336	342	348	354 1/2	360 1/2	366
49	324	330	336	342	348	354	360 1/2	366 1/2	372
50	330	336	342	348	354	360	366 1/2	372 1/2	378
51	336	342	348	354	360	366	372 1/2	378 1/2	384
52	342	348	354	360	366	372	378 1/2	384 1/2	390
53	348	354	360	366	372	378	384 1/2	390 1/2	396
54	354	360	366	372	378	384	390 1/2	396 1/2	402
55	360	366	372	378	384	390	396 1/2	402 1/2	408
56	366	372	378	384	390	396	402 1/2	408 1/2	414
57	372	378	384	390	396	402	408 1/2	414 1/2	420
58	378	384	390	396	402	408	414 1/2	420 1/2	426
59	384	390	396	402	408	414	420 1/2	426 1/2	432
60	390	396	402	408	414	420	426 1/2	432 1/2	438
61	396	402	408	414	420	426	432 1/2	438 1/2	444
62	402	408	414	420	426	432	438 1/2	444 1/2	450
63	408	414	420	426	432	438	444 1/2	450 1/2	456
64	414	420	426	432	438	444	450 1/2	456 1/2	462
65	420	426	432	438	444	450	456 1/2	462 1/2	468
66	426	432	438	444	450	456	462 1/2	468 1/2	474
67	432	438	444	450	456	462	468 1/2	474 1/2	480
68	438	444	450	456	462	468	474 1/2	480 1/2	486
69	444	450	456	462	468	474	480 1/2	486 1/2	492
70	450	456	462	468	474	480	486 1/2	492 1/2	498
71	456	462	468	474	480	486	492 1/2	498 1/2	504
72	462	468	474	480	486	492	498 1/2	504 1/2	510
73	468	474	480	486	492	498	504 1/2	510 1/2	516
74	474	480	486	492	498	504	510 1/2	516 1/2	522
75	480	486	492	498	504	510	516 1/2	522 1/2	528
76	486	492	498	504	510	516	522 1/2	528 1/2	534
77	492	498	504	510	516	522	528 1/2	534 1/2	540
78	498	504	510	516	522	528	534 1/2	540 1/2	546
79	504	510	516	522	528	534	540 1/2	546 1/2	552
80	510	516	522	528	534	540	546 1/2	552 1/2	558
81	516	522	528	534	540	546	552 1/2	558 1/2	564
82	522	528	534	540	546	552	558 1/2	564 1/2	570
83	528	534	540	546	552	558	564 1/2	570 1/2	576
84	534	540	546	552	558	564	570 1/2	576 1/2	582
85	540	546	552	558	564	570	576 1/2	582 1/2	588
86	546	552	558	564	570	576	582 1/2	588 1/2	594
87	552	558	564	570	576	582	588 1/2	594 1/2	600
88	558	564	570	576	582	588	594 1/2	600 1/2	606
89	564	570	576	582	588	594	600 1/2	606 1/2	612
90	570	576	582	588	594	600	606 1/2	612 1/2	618
91	576	582	588	594	600	606	612 1/2	618 1/2	624
92	582	588	594	600	606	612	618 1/2	624 1/2	630
93	588	594	600	606	612	618	624 1/2	630 1/2	636
94	594	600	606	612	618	624	630 1/2	636 1/2	642
95	600	606	612	618	624	630	636 1/2	642 1/2	648
96	606	612	618	624	630	636	642 1/2	648 1/2	654
97	612	618	624	630	636	642	648 1/2	654 1/2	660
98	618	624	630	636	642	648	654 1/2	660 1/2	666
99	624	630	636	642	648	654	660 1/2	666 1/2	672
100	630	636	642	648	654	660	666 1/2	672 1/2	678

9-INCH WHEEL

Head.	Revolutions per Minute	Discharge, Cubic Feet per Second	Horse Power
	20.7	20.4	1.5
	21.5	21.3	1.6
	22.3	22.1	1.7
1	23.1	22.9	1.8
2	23.9	23.7	1.9
3	24.7	24.5	2.0
4	25.5	25.3	2.1
5	26.3	26.1	2.2
6	27.1	26.9	2.3
7	27.9	27.7	2.4
8	28.7	28.5	2.5
9	29.5	29.3	2.6
10	30.3	30.1	2.7
11	31.1	30.9	2.8
12	31.9	31.7	2.9
13	32.7	32.5	3.0
14	33.5	33.3	3.1
15	34.3	34.1	3.2
16	35.1	34.9	3.3
17	35.9	35.7	3.4
18	36.7	36.5	3.5
19	37.5	37.3	3.6
20	38.3	38.1	3.7
21	39.1	38.9	3.8
22	39.9	39.7	3.9
23	40.7	40.5	4.0
24	41.5	41.3	4.1
25	42.3	42.1	4.2
26	43.1	42.9	4.3
27	43.9	43.7	4.4
28	44.7	44.5	4.5
29	45.5	45.3	4.6
30	46.3	46.1	4.7
31	47.1	46.9	4.8
32	47.9	47.7	4.9
33	48.7	48.5	5.0
34	49.5	49.3	5.1
35	50.3	50.1	5.2
36	51.1	50.9	5.3
37	51.9	51.7	5.4
38	52.7	52.5	5.5
39	53.5	53.3	5.6
40	54.3	54.1	5.7
41	55.1	54.9	5.8
42	55.9	55.7	5.9
43	56.7	56.5	6.0
44	57.5	57.3	6.1
45	58.3	58.1	6.2
46	59.1	58.9	6.3
47	59.9	59.7	6.4
48	60.7	60.5	6.5
49	61.5	61.3	6.6
50	62.3	62.1	6.7
51	63.1	62.9	6.8
52	63.9	63.7	6.9
53	64.7	64.5	7.0
54	65.5	65.3	7.1
55	66.3	66.1	7.2
56	67.1	66.9	7.3
57	67.9	67.7	7.4
58	68.7	68.5	7.5
59	69.5	69.3	7.6
60	70.3	70.1	7.7
61	71.1	70.9	7.8
62	71.9	71.7	7.9
63	72.7	72.5	8.0
64	73.5	73.3	8.1
65	74.3	74.1	8.2
66	75.1	74.9	8.3
67	75.9	75.7	8.4
68	76.7	76.5	8.5
69	77.5	77.3	8.6
70	78.3	78.1	8.7
71	79.1	78.9	8.8
72	79.9	79.7	8.9
73	80.7	80.5	9.0
74	81.5	81.3	9.1
75	82.3	82.1	9.2
76	83.1	82.9	9.3
77	83.9	83.7	9.4
78	84.7	84.5	9.5
79	85.5	85.3	9.6
80	86.3	86.1	9.7
81	87.1	86.9	9.8
82	87.9	87.7	9.9
83	88.7	88.5	10.0
84	89.5	89.3	10.1
85	90.3	90.1	10.2
86	91.1	90.9	10.3
87	91.9	91.7	10.4
88	92.7	92.5	10.5
89	93.5	93.3	10.6
90	94.3	94.1	10.7
91	95.1	94.9	10.8
92	95.9	95.7	10.9
93	96.7	96.5	11.0
94	97.5	97.3	11.1
95	98.3	98.1	11.2
96	99.1	98.9	11.3
97	99.9	99.7	11.4
98	100.7	100.5	11.5
99	101.5	101.3	11.6
100	102.3	102.1	11.7

9-INCH WHEEL

Depth	Velocity in Feet per Second	Discharge Cubic Feet per Minute	Horse Power
4.1	8.5	5.4	3.2
4.2	8.7	5.7	3.5
4.3	8.9	6.0	3.8
4.4	9.1	6.3	4.2
4.5	9.3	6.6	4.6
4.6	9.5	6.9	5.0
4.7	9.7	7.2	5.4
4.8	9.9	7.5	5.8
4.9	10.1	7.8	6.2
5.0	10.3	8.1	6.6
5.1	10.5	8.4	7.0
5.2	10.7	8.7	7.4
5.3	10.9	9.0	7.8
5.4	11.1	9.3	8.2
5.5	11.3	9.6	8.6
5.6	11.5	9.9	9.0
5.7	11.7	10.2	9.4
5.8	11.9	10.5	9.8
5.9	12.1	10.8	10.2
6.0	12.3	11.1	10.6
6.1	12.5	11.4	11.0
6.2	12.7	11.7	11.4
6.3	12.9	12.0	11.8
6.4	13.1	12.3	12.2
6.5	13.3	12.6	12.6
6.6	13.5	12.9	13.0
6.7	13.7	13.2	13.4
6.8	13.9	13.5	13.8
6.9	14.1	13.8	14.2
7.0	14.3	14.1	14.6
7.1	14.5	14.4	15.0
7.2	14.7	14.7	15.4
7.3	14.9	15.0	15.8
7.4	15.1	15.3	16.2
7.5	15.3	15.6	16.6
7.6	15.5	15.9	17.0
7.7	15.7	16.2	17.4
7.8	15.9	16.5	17.8
7.9	16.1	16.8	18.2
8.0	16.3	17.1	18.6
8.1	16.5	17.4	19.0
8.2	16.7	17.7	19.4
8.3	16.9	18.0	19.8
8.4	17.1	18.3	20.2
8.5	17.3	18.6	20.6
8.6	17.5	18.9	21.0
8.7	17.7	19.2	21.4
8.8	17.9	19.5	21.8
8.9	18.1	19.8	22.2
9.0	18.3	20.1	22.6
9.1	18.5	20.4	23.0
9.2	18.7	20.7	23.4
9.3	18.9	21.0	23.8
9.4	19.1	21.3	24.2
9.5	19.3	21.6	24.6
9.6	19.5	21.9	25.0
9.7	19.7	22.2	25.4
9.8	19.9	22.5	25.8
9.9	20.1	22.8	26.2
10.0	20.3	23.1	26.6

12-INCH WHEEL

Head	Top of wheel to center	Center of wheel to center of wheel	Center of wheel to center of wheel
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
43	43	43	43
44	44	44	44
45	45	45	45
46	46	46	46
47	47	47	47
48	48	48	48
49	49	49	49
50	50	50	50
51	51	51	51
52	52	52	52
53	53	53	53
54	54	54	54
55	55	55	55
56	56	56	56
57	57	57	57
58	58	58	58
59	59	59	59
60	60	60	60
61	61	61	61
62	62	62	62
63	63	63	63
64	64	64	64
65	65	65	65
66	66	66	66
67	67	67	67
68	68	68	68
69	69	69	69
70	70	70	70
71	71	71	71
72	72	72	72
73	73	73	73
74	74	74	74
75	75	75	75
76	76	76	76
77	77	77	77
78	78	78	78
79	79	79	79
80	80	80	80
81	81	81	81
82	82	82	82
83	83	83	83
84	84	84	84
85	85	85	85
86	86	86	86
87	87	87	87
88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

12-INCH WHEEL

Head	Revolutions per Minute	Discharge in Cubic Feet per Minute	Horse Power
47	638	1017	65.0
49	643	1024	65.3
51	653	1037	66.1
53	660	1053	66.7
56	676	1075	67.4
59	685	1077	67.5
67	683	1084	67.5
68	690	1086	67.6
71	697	1092	67.7
74	714	1124	68.8
76	718	1125	68.8
79	722	1127	68.9
81	723	1128	68.9
83	724	1129	68.9
86	731	1130	69.0
88	731	1131	69.0
91	739	1134	69.1
93	743	1135	69.1
96	746	1136	69.2
99	750	1137	69.2
101	751	1137	69.2
103	751	1137	69.2
106	757	1140	69.3
108	758	1140	69.3
111	761	1141	69.3
113	762	1141	69.3
116	765	1142	69.4
118	766	1142	69.4
121	768	1143	69.4
123	769	1143	69.4
126	771	1144	69.4
128	772	1144	69.4
131	774	1145	69.5
133	775	1145	69.5
136	777	1146	69.5
138	778	1146	69.5
141	780	1147	69.5
143	781	1147	69.5
146	783	1148	69.6
148	784	1148	69.6
151	786	1149	69.6
153	787	1149	69.6
156	789	1150	69.6
158	790	1150	69.6
161	792	1151	69.7
163	793	1151	69.7
166	795	1152	69.7
168	796	1152	69.7
171	798	1153	69.7
173	799	1153	69.7
176	801	1154	69.8
178	802	1154	69.8
181	804	1155	69.8
183	805	1155	69.8
186	807	1156	69.8
188	808	1156	69.8
191	810	1157	69.9
193	811	1157	69.9
196	813	1158	69.9
198	814	1158	69.9
201	816	1159	69.9
203	817	1159	69.9
206	819	1160	70.0
208	820	1160	70.0
211	822	1161	70.0
213	823	1161	70.0
216	825	1162	70.0
218	826	1162	70.0
221	828	1163	70.1
223	829	1163	70.1
226	831	1164	70.1
228	832	1164	70.1
231	834	1165	70.1
233	835	1165	70.1
236	837	1166	70.2
238	838	1166	70.2
241	840	1167	70.2
243	841	1167	70.2
246	843	1168	70.2
248	844	1168	70.2
251	846	1169	70.3
253	847	1169	70.3
256	849	1170	70.3
258	850	1170	70.3
261	852	1171	70.3
263	853	1171	70.3
266	855	1172	70.4
268	856	1172	70.4
271	858	1173	70.4
273	859	1173	70.4
276	861	1174	70.4
278	862	1174	70.4
281	864	1175	70.5
283	865	1175	70.5
286	867	1176	70.5
288	868	1176	70.5
291	870	1177	70.5
293	871	1177	70.5
296	873	1178	70.6
298	874	1178	70.6
301	876	1179	70.6
303	877	1179	70.6
306	879	1180	70.6
308	880	1180	70.6
311	882	1181	70.7
313	883	1181	70.7
316	885	1182	70.7
318	886	1182	70.7
321	888	1183	70.7
323	889	1183	70.7
326	891	1184	70.8
328	892	1184	70.8
331	894	1185	70.8
333	895	1185	70.8
336	897	1186	70.8
338	898	1186	70.8
341	900	1187	70.9
343	901	1187	70.9
346	903	1188	70.9
348	904	1188	70.9
351	906	1189	70.9
353	907	1189	70.9
356	909	1190	71.0
358	910	1190	71.0
361	912	1191	71.0
363	913	1191	71.0
366	915	1192	71.0
368	916	1192	71.0
371	918	1193	71.1
373	919	1193	71.1
376	921	1194	71.1
378	922	1194	71.1
381	924	1195	71.1
383	925	1195	71.1
386	927	1196	71.2
388	928	1196	71.2
391	930	1197	71.2
393	931	1197	71.2
396	933	1198	71.2
398	934	1198	71.2
401	936	1199	71.3
403	937	1199	71.3
406	939	1200	71.3
408	940	1200	71.3
411	942	1201	71.3
413	943	1201	71.3
416	945	1202	71.4
418	946	1202	71.4
421	948	1203	71.4
423	949	1203	71.4
426	951	1204	71.4
428	952	1204	71.4
431	954	1205	71.5
433	955	1205	71.5
436	957	1206	71.5
438	958	1206	71.5
441	960	1207	71.5
443	961	1207	71.5
446	963	1208	71.6
448	964	1208	71.6
451	966	1209	71.6
453	967	1209	71.6
456	969	1210	71.6
458	970	1210	71.6
461	972	1211	71.7
463	973	1211	71.7
466	975	1212	71.7
468	976	1212	71.7
471	978	1213	71.7
473	979	1213	71.7
476	981	1214	71.8
478	982	1214	71.8
481	984	1215	71.8
483	985	1215	71.8
486	987	1216	71.8
488	988	1216	71.8
491	990	1217	71.9
493	991	1217	71.9
496	993	1218	71.9
498	994	1218	71.9
501	996	1219	71.9
503	997	1219	71.9
506	999	1220	72.0
508	1000	1220	72.0

15-INCH WHEEL

Head	Revolutions per Minute.	Pressure in Pounds	Head Pressure
5	750	100	4.5
1	750	100	4.5
2	750	100	4.5
3	750	100	4.5
4	750	100	4.5
5	750	100	4.5
6	750	100	4.5
7	750	100	4.5
8	750	100	4.5
9	750	100	4.5
10	750	100	4.5
11	750	100	4.5
12	750	100	4.5
13	750	100	4.5
14	750	100	4.5
15	750	100	4.5
16	750	100	4.5
17	750	100	4.5
18	750	100	4.5
19	750	100	4.5
20	750	100	4.5
21	750	100	4.5
22	750	100	4.5
23	750	100	4.5
24	750	100	4.5
25	750	100	4.5
26	750	100	4.5
27	750	100	4.5
28	750	100	4.5
29	750	100	4.5
30	750	100	4.5
31	750	100	4.5
32	750	100	4.5
33	750	100	4.5
34	750	100	4.5
35	750	100	4.5
36	750	100	4.5
37	750	100	4.5
38	750	100	4.5
39	750	100	4.5
40	750	100	4.5
41	750	100	4.5
42	750	100	4.5
43	750	100	4.5
44	750	100	4.5
45	750	100	4.5
46	750	100	4.5
47	750	100	4.5
48	750	100	4.5
49	750	100	4.5
50	750	100	4.5
51	750	100	4.5
52	750	100	4.5
53	750	100	4.5
54	750	100	4.5
55	750	100	4.5
56	750	100	4.5
57	750	100	4.5
58	750	100	4.5
59	750	100	4.5
60	750	100	4.5
61	750	100	4.5
62	750	100	4.5
63	750	100	4.5
64	750	100	4.5
65	750	100	4.5
66	750	100	4.5
67	750	100	4.5
68	750	100	4.5
69	750	100	4.5
70	750	100	4.5
71	750	100	4.5
72	750	100	4.5
73	750	100	4.5
74	750	100	4.5
75	750	100	4.5
76	750	100	4.5
77	750	100	4.5
78	750	100	4.5
79	750	100	4.5
80	750	100	4.5
81	750	100	4.5
82	750	100	4.5
83	750	100	4.5
84	750	100	4.5
85	750	100	4.5
86	750	100	4.5
87	750	100	4.5
88	750	100	4.5
89	750	100	4.5
90	750	100	4.5
91	750	100	4.5
92	750	100	4.5
93	750	100	4.5
94	750	100	4.5
95	750	100	4.5
96	750	100	4.5
97	750	100	4.5
98	750	100	4.5
99	750	100	4.5
100	750	100	4.5

15-INCH WHEEL

Head.	Revolutions per min.	Discharge, Cubic feet per minute.	Horse Power
41	510	1601	11.4
42	516	1611	11.5
43	522	1621	11.6
44	528	1631	11.7
45	534	1641	11.8
46	540	1651	11.9
47	546	1661	12.0
48	552	1671	12.1
49	558	1681	12.2
50	564	1691	12.3
51	570	1701	12.4
52	576	1711	12.5
53	582	1721	12.6
54	588	1731	12.7
55	594	1741	12.8
56	600	1751	12.9
57	606	1761	13.0
58	612	1771	13.1
59	618	1781	13.2
60	624	1791	13.3
61	630	1801	13.4
62	636	1811	13.5
63	642	1821	13.6
64	648	1831	13.7
65	654	1841	13.8
66	660	1851	13.9
67	666	1861	14.0
68	672	1871	14.1
69	678	1881	14.2
70	684	1891	14.3
71	690	1901	14.4
72	696	1911	14.5
73	702	1921	14.6
74	708	1931	14.7
75	714	1941	14.8
76	720	1951	14.9
77	726	1961	15.0
78	732	1971	15.1
79	738	1981	15.2
80	744	1991	15.3

24-INCH WHEEL

Head.	Revolutions per Min.	Force in Pounds	Horse Power
5	13	1	0
6	12	1	0.4
7	11	1	0.8
8	10	1	1.2
9	9	1	1.6
10	8	1	2.0
11	7	1	2.4
12	6	1	2.8
13	5	1	3.2
14	4	1	3.6
15	3	1	4.0
16	2	1	4.4
17	1	1	4.8
18	0.5	1	5.2
19	0.25	1	5.6
20	0.125	1	6.0
21	0.0625	1	6.4
22	0.03125	1	6.8
23	0.015625	1	7.2
24	0.0078125	1	7.6
25	0.00390625	1	8.0
26	0.001953125	1	8.4
27	0.0009765625	1	8.8
28	0.00048828125	1	9.2
29	0.000244140625	1	9.6
30	0.0001220703125	1	10.0

27-INCH WHEEL

Revs.	Revolutions per Minute	Discharge Cubic Feet per Minute.	Horse Power.
1	1000	1.044	1.35
2	500	1.12	1.45
3	333	1.17	1.5
4	250	1.22	1.55
5	200	1.27	1.6
6	166	1.32	1.65
7	142	1.37	1.7
8	125	1.42	1.75
9	111	1.47	1.8
10	100	1.52	1.85
12	83	1.62	1.95
15	66	1.72	2.05
20	50	1.87	2.2
25	40	2.02	2.35
30	33	2.17	2.5
40	25	2.37	2.75
50	20	2.57	3.0
60	16	2.77	3.25
75	12	3.02	3.5
100	10	3.27	3.75
125	8	3.52	4.0
150	6	3.77	4.25
200	4	4.27	4.75
250	3	4.77	5.25
300	2	5.27	5.75
400	1	5.77	6.25

30 INCH WHEEL

Head	Head in feet per Minute	Discharge Cub ft per Minute	Head in feet
1	13	1.1	1
2	14	1.2	2
3	15	1.3	3
4	16	1.4	4
5	17	1.5	5
6	18	1.6	6
7	19	1.7	7
8	20	1.8	8
9	21	1.9	9
10	22	2.0	10
11	23	2.1	11
12	24	2.2	12
13	25	2.3	13
14	26	2.4	14
15	27	2.5	15
16	28	2.6	16
17	29	2.7	17
18	30	2.8	18
19	31	2.9	19
20	32	3.0	20
21	33	3.1	21
22	34	3.2	22
23	35	3.3	23
24	36	3.4	24
25	37	3.5	25
26	38	3.6	26
27	39	3.7	27
28	40	3.8	28
29	41	3.9	29
30	42	4.0	30

33-INCH WHEEL

Head	Revolutions per Minute	Discharge, Cubic Feet per Minute	Horse Power
5	8	2.10	2.2
6	89	2.61	2.7
7	96	3.1	3.1
8	102	3.5	3.2
9	109	3.9	3.6
10	11	4.3	4.7
11	121	4.8	5
12	125	5.2	5.5
13	131	5.6	6
14	135	6.0	6.5
15	140	6.4	7
16	143	6.8	7.5
17	149	7.2	8
18	154	7.6	8.5
19	158	8.0	9
20	162	8.4	9.5
21	166	8.8	10
22	171	9.2	10.5
23	175	9.6	11
24	179	10.0	11.5
25	183	10.4	12
26	187	10.8	12.5
27	191	11.2	13
28	195	11.6	13.5
29	199	12.0	14
30	203	12.4	14.5
31	207	12.8	15
32	211	13.2	15.5
33	215	13.6	16
34	219	14.0	16.5
35	223	14.4	17
36	227	14.8	17.5
37	231	15.2	18
38	235	15.6	18.5
39	239	16.0	19
40	243	16.4	19.5

36-INCH WHEEL

[illegible]

39-INCH WHEEL

Head	Resistance per square inch	Displacement Cubic feet per minute	Head Feet
0	20.0	1.000	0.0
1	20.0	1.000	0.0
2	20.0	1.000	0.0
3	20.0	1.000	0.0
4	20.0	1.000	0.0
5	20.0	1.000	0.0
6	20.0	1.000	0.0
7	20.0	1.000	0.0
8	20.0	1.000	0.0
9	20.0	1.000	0.0
10	20.0	1.000	0.0
11	20.0	1.000	0.0
12	20.0	1.000	0.0
13	20.0	1.000	0.0
14	20.0	1.000	0.0
15	20.0	1.000	0.0
16	20.0	1.000	0.0
17	20.0	1.000	0.0
18	20.0	1.000	0.0
19	20.0	1.000	0.0
20	20.0	1.000	0.0
21	20.0	1.000	0.0
22	20.0	1.000	0.0
23	20.0	1.000	0.0
24	20.0	1.000	0.0
25	20.0	1.000	0.0
26	20.0	1.000	0.0
27	20.0	1.000	0.0
28	20.0	1.000	0.0
29	20.0	1.000	0.0
30	20.0	1.000	0.0
31	20.0	1.000	0.0
32	20.0	1.000	0.0
33	20.0	1.000	0.0
34	20.0	1.000	0.0
35	20.0	1.000	0.0
36	20.0	1.000	0.0
37	20.0	1.000	0.0
38	20.0	1.000	0.0
39	20.0	1.000	0.0
40	20.0	1.000	0.0

45-INCH WHEEL

Speed.	Revolutions per Minute	Discharge, Cubic ft. per Minute	Horse Power
1	1.1	1.1	1.1
2	2.2	2.2	2.2
3	3.3	3.3	3.3
4	4.4	4.4	4.4
5	5.5	5.5	5.5
6	6.6	6.6	6.6
7	7.7	7.7	7.7
8	8.8	8.8	8.8
9	9.9	9.9	9.9
10	11.0	11.0	11.0
12	13.2	13.2	13.2
14	15.4	15.4	15.4
16	17.6	17.6	17.6
18	19.8	19.8	19.8
20	22.0	22.0	22.0
22	24.2	24.2	24.2
24	26.4	26.4	26.4
26	28.6	28.6	28.6
28	30.8	30.8	30.8
30	33.0	33.0	33.0
32	35.2	35.2	35.2
34	37.4	37.4	37.4
36	39.6	39.6	39.6
38	41.8	41.8	41.8
40	44.0	44.0	44.0
42	46.2	46.2	46.2
44	48.4	48.4	48.4
46	50.6	50.6	50.6
48	52.8	52.8	52.8
50	55.0	55.0	55.0
52	57.2	57.2	57.2
54	59.4	59.4	59.4
56	61.6	61.6	61.6
58	63.8	63.8	63.8
60	66.0	66.0	66.0
62	68.2	68.2	68.2
64	70.4	70.4	70.4
66	72.6	72.6	72.6
68	74.8	74.8	74.8
70	77.0	77.0	77.0
72	79.2	79.2	79.2
74	81.4	81.4	81.4
76	83.6	83.6	83.6
78	85.8	85.8	85.8
80	88.0	88.0	88.0
82	90.2	90.2	90.2
84	92.4	92.4	92.4
86	94.6	94.6	94.6
88	96.8	96.8	96.8
90	99.0	99.0	99.0
92	101.2	101.2	101.2
94	103.4	103.4	103.4
96	105.6	105.6	105.6
98	107.8	107.8	107.8
100	110.0	110.0	110.0

48 INCH WHEEL

	Revolutions per Minute	Discharge, Cubic feet per Minute.	Horse Power.
5	100	1.0	4.4
6	120	1.4	6.2
7	140	1.8	8.0
8	160	2.2	9.8
9	180	2.6	11.6
10	200	3.0	13.4
12	240	3.6	16.1
14	280	4.2	18.8
16	320	4.8	21.5
18	360	5.4	24.2
20	400	6.0	26.9
22	440	6.6	29.6
24	480	7.2	32.3
26	520	7.8	35.0
28	560	8.4	37.7
30	600	9.0	40.4
32	640	9.6	43.1
34	680	10.2	45.8
36	720	10.8	48.5
38	760	11.4	51.2
40	800	12.0	53.9
42	840	12.6	56.6
44	880	13.2	59.3
46	920	13.8	62.0
48	960	14.4	64.7
50	1000	15.0	67.4
52	1040	15.6	70.1
54	1080	16.2	72.8
56	1120	16.8	75.5
58	1160	17.4	78.2
60	1200	18.0	80.9
62	1240	18.6	83.6
64	1280	19.2	86.3
66	1320	19.8	89.0
68	1360	20.4	91.7
70	1400	21.0	94.4
72	1440	21.6	97.1
74	1480	22.2	99.8
76	1520	22.8	102.5
78	1560	23.4	105.2
80	1600	24.0	107.9
82	1640	24.6	110.6
84	1680	25.2	113.3
86	1720	25.8	116.0
88	1760	26.4	118.7
90	1800	27.0	121.4
92	1840	27.6	124.1
94	1880	28.2	126.8
96	1920	28.8	129.5
98	1960	29.4	132.2
100	2000	30.0	134.9
102	2040	30.6	137.6
104	2080	31.2	140.3
106	2120	31.8	143.0
108	2160	32.4	145.7
110	2200	33.0	148.4
112	2240	33.6	151.1
114	2280	34.2	153.8
116	2320	34.8	156.5
118	2360	35.4	159.2
120	2400	36.0	161.9
122	2440	36.6	164.6
124	2480	37.2	167.3
126	2520	37.8	170.0
128	2560	38.4	172.7
130	2600	39.0	175.4
132	2640	39.6	178.1
134	2680	40.2	180.8
136	2720	40.8	183.5
138	2760	41.4	186.2
140	2800	42.0	188.9
142	2840	42.6	191.6
144	2880	43.2	194.3
146	2920	43.8	197.0
148	2960	44.4	199.7
150	3000	45.0	202.4
152	3040	45.6	205.1
154	3080	46.2	207.8
156	3120	46.8	210.5
158	3160	47.4	213.2
160	3200	48.0	215.9
162	3240	48.6	218.6
164	3280	49.2	221.3
166	3320	49.8	224.0
168	3360	50.4	226.7
170	3400	51.0	229.4
172	3440	51.6	232.1
174	3480	52.2	234.8
176	3520	52.8	237.5
178	3560	53.4	240.2
180	3600	54.0	242.9
182	3640	54.6	245.6
184	3680	55.2	248.3
186	3720	55.8	251.0
188	3760	56.4	253.7
190	3800	57.0	256.4
192	3840	57.6	259.1
194	3880	58.2	261.8
196	3920	58.8	264.5
198	3960	59.4	267.2
200	4000	60.0	269.9
202	4040	60.6	272.6
204	4080	61.2	275.3
206	4120	61.8	278.0
208	4160	62.4	280.7
210	4200	63.0	283.4
212	4240	63.6	286.1
214	4280	64.2	288.8
216	4320	64.8	291.5
218	4360	65.4	294.2
220	4400	66.0	296.9
222	4440	66.6	299.6
224	4480	67.2	302.3
226	4520	67.8	305.0
228	4560	68.4	307.7
230	4600	69.0	310.4
232	4640	69.6	313.1
234	4680	70.2	315.8
236	4720	70.8	318.5
238	4760	71.4	321.2
240	4800	72.0	323.9
242	4840	72.6	326.6
244	4880	73.2	329.3
246	4920	73.8	332.0
248	4960	74.4	334.7
250	5000	75.0	337.4
252	5040	75.6	340.1
254	5080	76.2	342.8
256	5120	76.8	345.5
258	5160	77.4	348.2
260	5200	78.0	350.9
262	5240	78.6	353.6
264	5280	79.2	356.3
266	5320	79.8	359.0
268	5360	80.4	361.7
270	5400	81.0	364.4
272	5440	81.6	367.1
274	5480	82.2	369.8
276	5520	82.8	372.5
278	5560	83.4	375.2
280	5600	84.0	377.9
282	5640	84.6	380.6
284	5680	85.2	383.3
286	5720	85.8	386.0
288	5760	86.4	388.7
290	5800	87.0	391.4
292	5840	87.6	394.1
294	5880	88.2	396.8
296	5920	88.8	399.5
298	5960	89.4	402.2
300	6000	90.0	404.9
302	6040	90.6	407.6
304	6080	91.2	410.3
306	6120	91.8	413.0
308	6160	92.4	415.7
310	6200	93.0	418.4
312	6240	93.6	421.1
314	6280	94.2	423.8
316	6320	94.8	426.5
318	6360	95.4	429.2
320	6400	96.0	431.9
322	6440	96.6	434.6
324	6480	97.2	437.3
326	6520	97.8	440.0
328	6560	98.4	442.7
330	6600	99.0	445.4
332	6640	99.6	448.1
334	6680	100.2	450.8
336	6720	100.8	453.5
338	6760	101.4	456.2
340	6800	102.0	458.9
342	6840	102.6	461.6
344	6880	103.2	464.3
346	6920	103.8	467.0
348	6960	104.4	469.7
350	7000	105.0	472.4
352	7040	105.6	475.1
354	7080	106.2	477.8
356	7120	106.8	480.5
358	7160	107.4	483.2
360	7200	108.0	485.9
362	7240	108.6	488.6
364	7280	109.2	491.3
366	7320	109.8	494.0
368	7360	110.4	496.7
370	7400	111.0	499.4
372	7440	111.6	502.1
374	7480	112.2	504.8
376	7520	112.8	507.5
378	7560	113.4	510.2
380	7600	114.0	512.9
382	7640	114.6	515.6
384	7680	115.2	518.3
386	7720	115.8	521.0
388	7760	116.4	523.7
390	7800	117.0	526.4
392	7840	117.6	529.1
394	7880	118.2	531.8
396	7920	118.8	534.5
398	7960	119.4	537.2
400	8000	120.0	539.9
402	8040	120.6	542.6
404	8080	121.2	545.3
406	8120	121.8	548.0
408	8160	122.4	550.7
410	8200	123.0	553.4
412	8240	123.6	556.1
414	8280	124.2	558.8
416	8320	124.8	561.5
418	8360	125.4	564.2
420	8400	126.0	566.9
422	8440	126.6	569.6
424	8480	127.2	572.3
426	8520	127.8	575.0
428	8560	128.4	577.7
430	8600	129.0	580.4
432	8640	129.6	583.1
434	8680	130.2	585.8
436	8720	130.8	588.5
438	8760	131.4	591.2
440	8800	132.0	593.9
442	8840	132.6	596.6
444	8880	133.2	599.3
446	8920	133.8	602.0
448	8960	134.4	604.7
450	9000	135.0	607.4
452	9040	135.6	610.1
454	9080	136.2	612.8
456	9120	136.8	615.5
458	9160	137.4	618.2
460	9200	138.0	620.9
462	9240	138.6	623.6
464	9280	139.2	626.3
466	9320	139.8	629.0
468	9360	140.4	631.7
470	9400	141.0	634.4
472	9440	141.6	637.1
474	9480	142.2	639.8
476	9520	142.8	642.5
478	9560	143.4	645.2
480	9600	144.0	647.9
482	9640	144.6	650.6
484	9680	145.2	653.3
486	9720	145.8	656.0
488	9760	146.4	658.7
490	9800	147.0	661.4
492	9840	147.6	664.1
494	9880	148.2	666.8
496	9920	148.8	669.5
498	9960	149.4	672.2
500	10000	150.0	674.9

51 INCH WHEEL

Head.	Revolutions per Minute.	Discharge Cubic Feet per Minute.	Horse Power
5	56	62.45	45.3
6	61	77.73	65.2
7	66	97.15	83.2
8	70	120.72	105.4
9	75	148.58	132.4
10	79	180.67	164.2
11	84	217.05	201.4
12	89	257.81	244.2
13	94	302.94	292.7
14	99	352.42	347.1
15	104	406.24	407.4
16	109	464.40	473.4
17	114	526.90	545.2
18	119	593.72	622.8
19	124	664.86	706.2
20	129	740.32	795.4
21	134	820.10	890.4
22	139	904.20	992.2
23	144	992.62	1100.8
24	149	1085.36	1216.2
25	154	1182.42	1339.4
26	159	1283.80	1470.4
27	164	1389.50	1609.2
28	169	1499.52	1756.8
29	174	1613.86	1913.2
30	179	1732.52	2078.4
31	184	1855.60	2252.2
32	189	1983.10	2434.8
33	194	2115.02	2626.2
34	199	2251.36	2826.4
35	204	2392.12	3035.2
36	209	2537.30	3252.8
37	214	2686.90	3479.2
38	219	2840.92	3714.4
39	224	2999.36	3958.2
40	229	3162.22	4210.8
41	234	3329.60	4472.2
42	239	3501.50	4742.4
43	244	3677.92	5021.2
44	249	3858.86	5308.8
45	254	4044.32	5605.2
46	259	4234.40	5910.4
47	264	4429.10	6224.2
48	269	4628.42	6546.8
49	274	4832.36	6878.2
50	279	5040.92	7218.4
51	284	5254.10	7567.2
52	289	5471.90	7924.8
53	294	5694.32	8290.2
54	299	5921.36	8664.4
55	304	6153.02	9047.2
56	309	6389.30	9438.8
57	314	6630.20	9839.2
58	319	6875.72	10248.4
59	324	7125.86	10666.2
60	329	7380.62	11092.8
61	334	7640.00	11528.2
62	339	7904.00	11972.4
63	344	8172.62	12424.2
64	349	8445.86	12884.8
65	354	8722.72	13354.2
66	359	9003.20	13832.4
67	364	9287.30	14318.2
68	369	9575.02	14812.8
69	374	9866.36	15315.2
70	379	10161.32	15825.4
71	384	10460.90	16343.2
72	389	10764.10	16868.8
73	394	11070.92	17402.2
74	399	11381.36	17943.4
75	404	11695.42	18492.2
76	409	12013.10	19048.8
77	414	12334.40	19612.2
78	419	12659.32	20183.4
79	424	12987.86	20762.2
80	429	13319.02	21348.8
81	434	13653.80	21942.2
82	439	13992.20	22543.4
83	444	14334.22	23151.2
84	449	14678.86	23766.8
85	454	15026.12	24389.2
86	459	15376.00	25018.4
87	464	15728.50	25654.2
88	469	16083.62	26296.8
89	474	16441.36	26946.2
90	479	16801.72	27603.4
91	484	17164.70	28267.2
92	489	17529.30	28938.8
93	494	17896.52	29617.2
94	499	18266.36	30302.4
95	504	18638.82	30994.2
96	509	19013.90	31692.8
97	514	19391.60	32398.2
98	519	19771.92	33110.4
99	524	20154.86	33829.2
100	529	20539.42	34554.8

54-INCH WHEEL

Revol.	Revol. in 10 ft. Dist. 100 ft.	$\frac{D}{C} \times \frac{P}{P_c} \times \frac{C_c}{C} \times \frac{P_c}{P}$	Horizontal Force
1	5	1.00	1.00
2	10	1.00	1.00
3	15	1.00	1.00
4	20	1.00	1.00
5	25	1.00	1.00
6	30	1.00	1.00
7	35	1.00	1.00
8	40	1.00	1.00
9	45	1.00	1.00
10	50	1.00	1.00
11	55	1.00	1.00
12	60	1.00	1.00
13	65	1.00	1.00
14	70	1.00	1.00
15	75	1.00	1.00
16	80	1.00	1.00
17	85	1.00	1.00
18	90	1.00	1.00
19	95	1.00	1.00
20	100	1.00	1.00
21	105	1.00	1.00
22	110	1.00	1.00
23	115	1.00	1.00
24	120	1.00	1.00
25	125	1.00	1.00
26	130	1.00	1.00
27	135	1.00	1.00
28	140	1.00	1.00
29	145	1.00	1.00
30	150	1.00	1.00
31	155	1.00	1.00
32	160	1.00	1.00
33	165	1.00	1.00
34	170	1.00	1.00
35	175	1.00	1.00
36	180	1.00	1.00
37	185	1.00	1.00
38	190	1.00	1.00
39	195	1.00	1.00
40	200	1.00	1.00
41	205	1.00	1.00
42	210	1.00	1.00
43	215	1.00	1.00
44	220	1.00	1.00
45	225	1.00	1.00
46	230	1.00	1.00
47	235	1.00	1.00
48	240	1.00	1.00
49	245	1.00	1.00
50	250	1.00	1.00
51	255	1.00	1.00
52	260	1.00	1.00
53	265	1.00	1.00
54	270	1.00	1.00
55	275	1.00	1.00
56	280	1.00	1.00
57	285	1.00	1.00
58	290	1.00	1.00
59	295	1.00	1.00
60	300	1.00	1.00
61	305	1.00	1.00
62	310	1.00	1.00
63	315	1.00	1.00
64	320	1.00	1.00
65	325	1.00	1.00
66	330	1.00	1.00
67	335	1.00	1.00
68	340	1.00	1.00
69	345	1.00	1.00
70	350	1.00	1.00
71	355	1.00	1.00
72	360	1.00	1.00
73	365	1.00	1.00
74	370	1.00	1.00
75	375	1.00	1.00
76	380	1.00	1.00
77	385	1.00	1.00
78	390	1.00	1.00
79	395	1.00	1.00
80	400	1.00	1.00
81	405	1.00	1.00
82	410	1.00	1.00
83	415	1.00	1.00
84	420	1.00	1.00
85	425	1.00	1.00
86	430	1.00	1.00
87	435	1.00	1.00
88	440	1.00	1.00
89	445	1.00	1.00
90	450	1.00	1.00
91	455	1.00	1.00
92	460	1.00	1.00
93	465	1.00	1.00
94	470	1.00	1.00
95	475	1.00	1.00
96	480	1.00	1.00
97	485	1.00	1.00
98	490	1.00	1.00
99	495	1.00	1.00
100	500	1.00	1.00

57-INCH WHEEL

Head.	Revolutions per Minute	Discharge, Cubic feet per Minute	Horse Power
5	50	21.36	65 3
6	40	24.72	65 4
7	30	28.31	65 5
8	25	33.7	32
9	20	39.1	5 5
10	15	45	18 15
11	10	50.5	3 3
12	7 1/2	55.5	4 2
13	5	60.4	5 1/2
14	3 1/2	65.4	5 1/2
15	2 1/2	70.7	3 3/4
16	2	76.2	3 3/4
17	1 1/2	81.8	4 1/2
18	1 1/4	86.6	4 1/2
19	1 1/8	91.5	4 3/4
20	1 1/2	96.7	5 1/2
21	1 1/4	102.0	5 1/2
22	1 1/8	107.3	6 1/2
23	1 1/2	112.6	6 1/2
24	1 1/4	118.1	6 3/4
25	1 1/8	123.4	7 1/2
26	1 1/2	128.7	7 1/2
27	1 1/4	134.1	8 1/2
28	1 1/8	139.5	8 1/2
29	1 1/2	145	9 1/2
30	1 1/4	150.4	9 1/2
31	1 1/8	155.8	10 1/2
32	1 1/2	161.3	10 1/2
33	1 1/4	166.7	11 1/2
34	1 1/8	172.2	11 1/2
35	1 1/2	177.7	12 1/2
36	1 1/4	183.2	12 1/2
37	1 1/8	188.7	13 1/2
38	1 1/2	194.2	13 1/2
39	1 1/4	199.7	14 1/2
40	1 1/8	205.2	14 1/2

60-INCH WHEEL

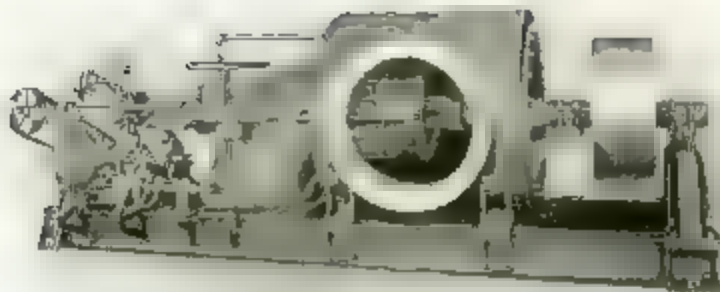
Height	Revolutions per Minute	Distance Covered in Minutes	Horse Power
4	4.2	1.5	1.5
5	4.5	1.5	1.5
6	4.8	1.5	1.5
7	5.1	1.5	1.5
8	5.4	1.5	1.5
9	5.7	1.5	1.5
10	6.0	1.5	1.5
11	6.3	1.5	1.5
12	6.6	1.5	1.5
13	6.9	1.5	1.5
14	7.2	1.5	1.5
15	7.5	1.5	1.5
16	7.8	1.5	1.5
17	8.1	1.5	1.5
18	8.4	1.5	1.5
19	8.7	1.5	1.5
20	9.0	1.5	1.5
21	9.3	1.5	1.5
22	9.6	1.5	1.5
23	9.9	1.5	1.5
24	10.2	1.5	1.5
25	10.5	1.5	1.5
26	10.8	1.5	1.5
27	11.1	1.5	1.5
28	11.4	1.5	1.5
29	11.7	1.5	1.5
30	12.0	1.5	1.5
31	12.3	1.5	1.5
32	12.6	1.5	1.5
33	12.9	1.5	1.5
34	13.2	1.5	1.5
35	13.5	1.5	1.5
36	13.8	1.5	1.5
37	14.1	1.5	1.5
38	14.4	1.5	1.5
39	14.7	1.5	1.5
40	15.0	1.5	1.5
41	15.3	1.5	1.5
42	15.6	1.5	1.5
43	15.9	1.5	1.5
44	16.2	1.5	1.5
45	16.5	1.5	1.5
46	16.8	1.5	1.5
47	17.1	1.5	1.5
48	17.4	1.5	1.5
49	17.7	1.5	1.5
50	18.0	1.5	1.5

66-INCH WHEEL

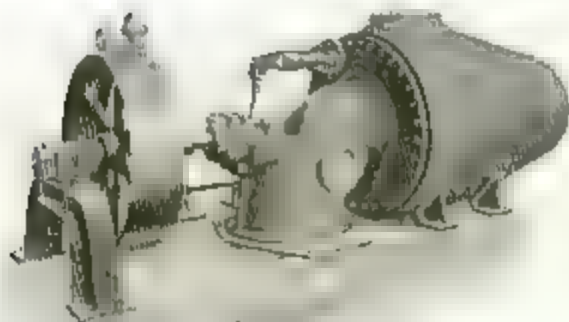
Head.	Revolutions per Minute.	Discharge Cubic Feet per Minute.	Horse Power
4	35	11.765	7.4
5	42	13.54	8.3
6	46	14.84	9.4
7	50	16.1	10.4
8	5	17.4	11.4
9	56	18.65	12.4
10	60	19.9	13.4
11	64	21.14	14.4
12	68	22.38	15.4
13	72	23.62	16.4
14	76	24.86	17.4
15	80	26.1	18.4
16	84	27.34	19.4
17	88	28.58	20.4
18	92	29.82	21.4
19	96	31.06	22.4
20	100	32.3	23.4
21	104	33.54	24.4
22	108	34.78	25.4
23	112	36.02	26.4
24	116	37.26	27.4
25	120	38.5	28.4
26	124	39.74	29.4
27	128	40.98	30.4
28	132	42.22	31.4
29	136	43.46	32.4
30	140	44.7	33.4
31	144	45.94	34.4
32	148	47.18	35.4
33	152	48.42	36.4
34	156	49.66	37.4
35	160	50.9	38.4
36	164	52.14	39.4
37	168	53.38	40.4
38	172	54.62	41.4
39	176	55.86	42.4
40	180	57.1	43.4

72-INCH WHEEL

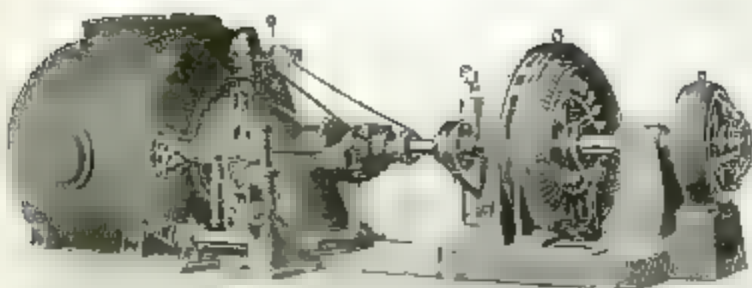
Depth	Revolutions per Minute	Distance— Cuts Feet per Min. Ls.	Horse Power
4	2	14.06	54.4
5	4.1	16.74	43.5
6	4.8	12.17	64.2
	4.1	14.54	45.3
8	5	2.924	252.9
9	5.5	7.91	31
11	5.9	2.117	3.5
12	6	2.157	3.7
13	6.1	2.137	4.6
14	6	2.641	5.1
		6.57	5.86
15	7	2.745	6.46
16	4	2.671	7.16
17		2.457	7.56.7
18	5.1	3.125	5.12
19	5	1.77	6.23
20	5.5	3.14	4.87
21	5.5	3.144	5.7
22	5.5	3.144	5.53
	5.5	3.144	5.53
23	5.1	3.64	3.19
24	5.1	3.64	3.19
25	5.5	3.717	3.25
26	5	3.773	3.24
27	5.6	3.515	3.65
28	5.6	3.61	3.56
29	5.8	3.717	3.46
30	5.8	3.717	3.2
31	5.8	3.717	3.2
32	5.8	3.717	3.2
33	5.8	3.717	3.2
34	5.8	3.717	3.2
35	5	3.717	3.2
36	5.2	3.717	3.2
37	5.2	3.717	3.2
38	5.2	3.717	3.2
39	5.2	3.717	3.2
40	5.2	3.717	3.2



Engraving No 406.



Engraving No 407



Engraving No. 408.

Single horizontal shaft type, the engine is fitted with a single cylinder and a horizontal shaft. The engine is a simple and generator and is equipped with a single cylinder and a horizontal shaft.



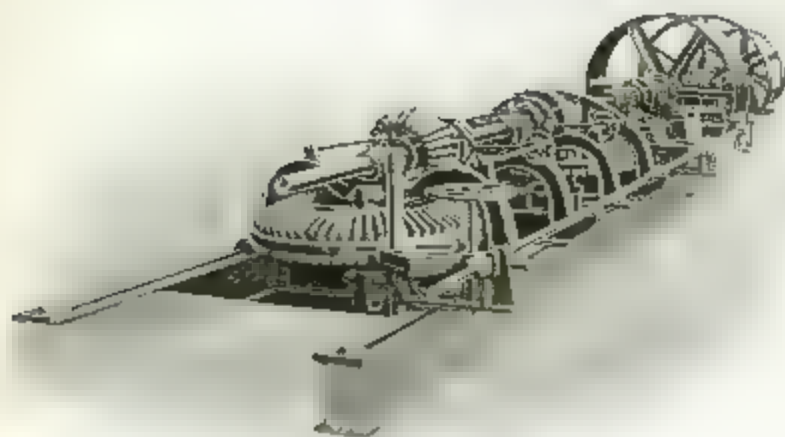
Engraving No. 409.

The engine is fitted with a single cylinder and a horizontal shaft. The engine is a simple and generator and is equipped with a single cylinder and a horizontal shaft.



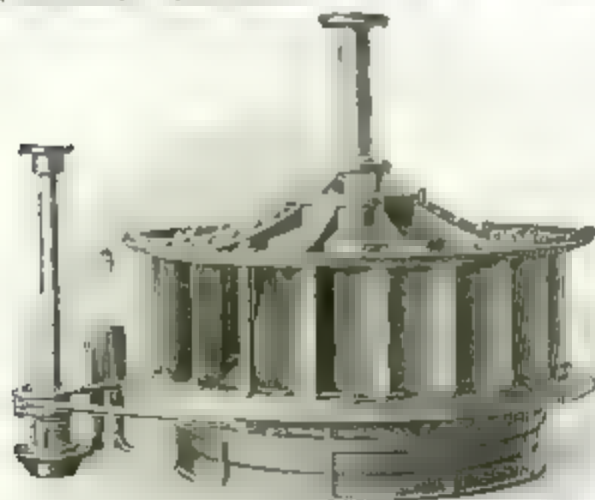
Engraving No. 410.

The above engraving is a representation of the engine of the
 steamship "Hercules" built at the Glasgow Dock Co. Works.
 The engine is of the compound type, and is capable of
 developing 1,000 horse power.



Engraving No. 411

This is a horizontal steam engine with a large flywheel at the rear. It is mounted on a sturdy base with a long horizontal support arm extending to the left. The machine is shown in a side view, highlighting its complex mechanical components.



Engraving No. 412

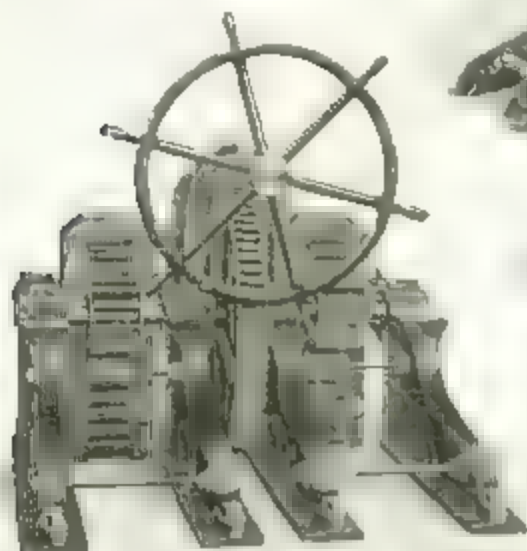
This is a vertical steam engine with a large vertical cylinder and a horizontal base. It is mounted on a sturdy base with a tall vertical support structure on the left. The machine is shown in a front view, highlighting its symmetrical design and various mechanical components.

Head Gate Hoists

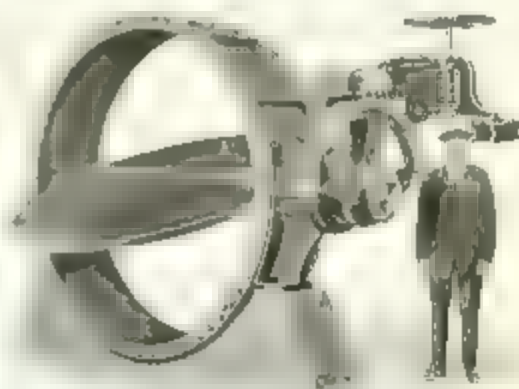
We have published special
 Engraving No. 180 relative ex-
 clusively to Head Gate Hoists and
 valves, copy of which will be
 mailed on application.



Engraving No. 413



Engraving No. 414



Engraving No. 415

Large water gate valve
 with worm geared hand
 operating mechanism

Measurement of Large Streams

where the velo-

city is in units

of velocity in feet per

second in the center the

may usually be lost 20 per cent. for losses by friction, etc.

Measurement of Water Through Openings Under Pressure

Table giving the nom-
inal discharge through an or-
ifice in feet

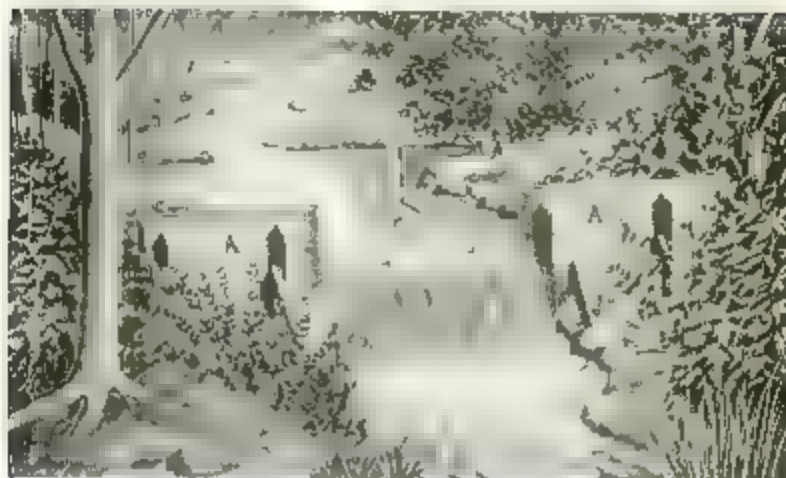
Orifice Diameter	Head in feet	Cubic feet per second	Head in feet	Cubic feet per second	Head in feet	Cubic feet per second	Head in feet	Cubic feet per second	Head in feet	Cubic feet per second
1	1	0.0001	2	0.0004	3	0.0009	4	0.0016	5	0.0025
2	1	0.0004	2	0.0016	3	0.0036	4	0.0064	5	0.01
3	1	0.0009	2	0.0036	3	0.0081	4	0.0144	5	0.0225
4	1	0.0016	2	0.0064	3	0.0144	4	0.0256	5	0.04
5	1	0.0025	2	0.01	3	0.0225	4	0.04	5	0.0625
6	1	0.0036	2	0.0144	3	0.0324	4	0.0576	5	0.09
7	1	0.0049	2	0.0196	3	0.0441	4	0.0784	5	0.1225
8	1	0.0064	2	0.0256	3	0.0576	4	0.1024	5	0.16
9	1	0.0081	2	0.0324	3	0.0729	4	0.1296	5	0.225
10	1	0.01	2	0.04	3	0.09	4	0.16	5	0.25
11	1	0.0121	2	0.0484	3	0.1089	4	0.1936	5	0.3025
12	1	0.0144	2	0.0576	3	0.1296	4	0.2304	5	0.36
13	1	0.0169	2	0.0676	3	0.1521	4	0.2704	5	0.4225
14	1	0.0196	2	0.0784	3	0.1764	4	0.3136	5	0.49
15	1	0.0225	2	0.09	3	0.2025	4	0.36	5	0.5625
16	1	0.0256	2	0.1024	3	0.2304	4	0.4096	5	0.64
17	1	0.0289	2	0.1156	3	0.2601	4	0.4624	5	0.7225
18	1	0.0324	2	0.1296	3	0.2916	4	0.5184	5	0.81
19	1	0.0361	2	0.1444	3	0.3249	4	0.5776	5	0.9025
20	1	0.04	2	0.16	3	0.36	4	0.64	5	1.0

EXAMPLE SHOWING APPLICATION OF ABOVE TABLE

Suppose the orifice is 10 inches long and the gate is 10 inches high. The head of water is 10 feet. The discharge is 10 cubic feet per second. The area of the gate is 100 square inches.

The discharge is 10 cubic feet per second. The head of water is 10 feet. The area of the gate is 100 square inches. The discharge is 10 cubic feet per second.

Rules for Measuring Water by Weirs



ENERGYING No. 416.

The following rule is given for determining the amount of water in a small stream:

[illegible]

Table Showing the Quantity of Water Passing Over Weirs in Cubic Feet per Minute

Depth of water over weir in feet	Cubic feet per minute passed per inch of length of weir	Length of weir in feet	Cubic feet per minute passed over weir	Depth of water over weir in feet	Cubic feet per minute passed per inch of length of weir	Length of weir in feet	Cubic feet per minute passed over weir
1	4.85	1	4.85	8	170.18	12	214.32
1 1/8	5.78	1	5.78	8 1/8	172.82	12	220.76
1 1/4	6.68	1	6.68	8 1/4	175.2	12	227.04
1 3/8	7.56	1	7.56	8 3/8	178.4	12	233.28
1 1/2	8.44	1 1/2	12.66	9	180.93	13 1/2	240.84
1 5/8	10.40	1 5/8	16.62	9 1/8	183.65	13 1/8	247.22
1 3/4	11.2	1 3/4	16.8	9 3/8	184.43	14	254.12
1 7/8	12.0	1 7/8	17.08	9 1/2	187.18	14	260.84
2	12.72	2	25.44	9 3/4	189.90	14 1/2	267.72
2 1/8	13.5	2 1/8	27.0	9 7/8	191.80	14	274.70
2 1/4	14.36	2 1/4	28.44	10	193.64	15	281.72
2 3/8	15.2	2 3/8	30.16	10 1/8	194.47	15	288.82
2 1/2	16.0	2 1/2	32.0	10 3/8	195.3	15 1/2	295.64
2 5/8	16.8	2 5/8	33.6	10 1/2	196.7	16	303.1
2 3/4	17.6	2 3/4	35.52	10 3/4	198.14	16	310.36
2 7/8	18.4	2 7/8	36.96	10 7/8	198.7	16	317.72
3	19.2	3	38.4	11	199.84	17	325.2
3 1/8	20.0	3 1/8	40.0	11 1/8	200.93	17	332.7
3 1/4	20.8	3 1/4	41.76	11 1/4	202.02	17 1/2	340.36
3 3/8	21.6	3 3/8	43.2	11 3/8	203.13	18	348.14
3 1/2	22.4	3 1/2	45.12	11 1/2	204.13	18 1/2	356.0
3 5/8	23.2	3 5/8	46.56	11 3/4	205.2	19	364.0
3 3/4	24.0	3 3/4	48.0	11 7/8	206.27	19	372.1
3 7/8	24.8	3 7/8	49.44	12	207.34	20	380.28
4	25.6	4	51.2	12 1/8	208.4	20	388.48
4 1/8	26.4	4 1/8	52.8	12 1/4	209.47	21	396.7
4 1/4	27.2	4 1/4	54.4	12 3/8	210.52	21 1/2	405.04
4 3/8	28.0	4 3/8	56.0	12 1/2	211.57	22	413.48
4 1/2	28.8	4 1/2	57.6	12 3/4	212.6	22	421.92

For explanation of above table and construction of Weirs see opposite page

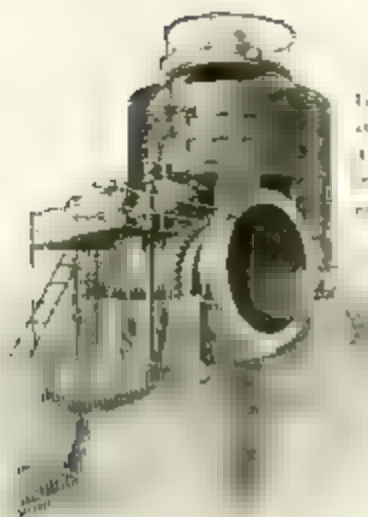
Velocity of Water

Table giving velocity of water in feet per second, and the cubic feet of water per minute, to develop one horse-power at 80 per cent efficiency, under head from 1 to 297 feet.

Head	Velocity	Cubic Feet	Head	Velocity	Cubic Feet	Head	Velocity	Cubic Feet
1	3.13	30.1	10	10.00	1000	20	14.14	2828
2	4.47	43.8	11	10.54	1058	21	14.49	2911
3	5.19	50.7	12	11.05	1118	22	14.83	2994
4	5.77	56.4	13	11.53	1177	23	15.16	3076
5	6.25	61.2	14	12.02	1235	24	15.49	3158
6	6.71	66.0	15	12.49	1293	25	15.81	3239
7	7.14	70.7	16	12.95	1350	26	16.13	3320
8	7.56	75.4	17	13.41	1407	27	16.45	3400
9	7.97	80.0	18	13.86	1464	28	16.77	3480
10	8.38	84.6	19	14.30	1520	29	17.09	3560
11	8.78	89.2	20	14.73	1576	30	17.40	3640
12	9.18	93.8	21	15.16	1632	31	17.71	3720
13	9.57	98.4	22	15.58	1687	32	18.02	3800
14	9.96	103.0	23	16.00	1743	33	18.33	3880
15	10.35	107.6	24	16.41	1798	34	18.64	3960
16	10.73	112.2	25	16.82	1853	35	18.95	4040
17	11.11	116.8	26	17.23	1908	36	19.26	4120
18	11.49	121.4	27	17.64	1963	37	19.57	4200
19	11.87	125.9	28	18.05	2018	38	19.88	4280
20	12.25	130.5	29	18.46	2073	39	20.19	4360
21	12.62	135.1	30	18.87	2128	40	20.50	4440
22	13.00	139.7	31	19.28	2183	41	20.81	4520
23	13.37	144.3	32	19.69	2238	42	21.12	4600
24	13.75	148.9	33	20.10	2293	43	21.43	4680
25	14.12	153.5	34	20.51	2348	44	21.74	4760
26	14.49	158.1	35	20.92	2403	45	22.05	4840
27	14.87	162.7	36	21.33	2458	46	22.36	4920
28	15.24	167.3	37	21.74	2513	47	22.67	5000
29	15.62	171.9	38	22.15	2568	48	22.98	5080
30	15.99	176.5	39	22.56	2623	49	23.29	5160
31	16.37	181.1	40	22.97	2678			
32	16.74	185.7						
33	17.12	190.3						
34	17.49	194.9						
35	17.87	200.0						
36	18.24	205.0						
37	18.62	210.0						
38	18.99	215.0						
39	19.37	220.0						
40	19.74	225.0						
41	20.12	230.0						
42	20.49	235.0						
43	20.87	240.0						
44	21.24	245.0						
45	21.62	250.0						
46	21.99	255.0						
47	22.37	260.0						
48	22.74	265.0						
49	23.12	270.0						

VELOCITY OF WATER. Continued

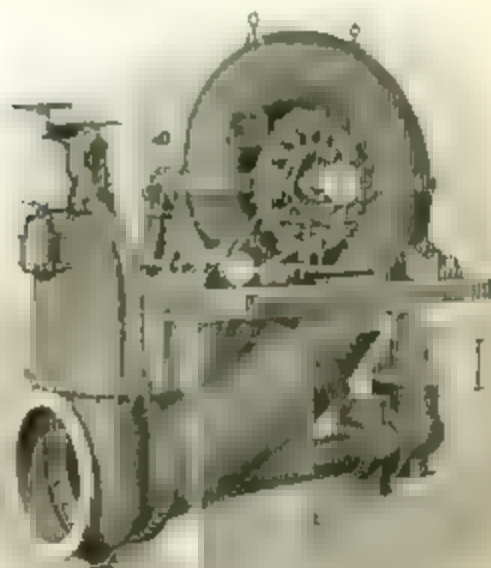
Bar	Velocity	Cubic Feet	Bar	Velocity	Cubic Feet	Bar	Velocity	Cubic Feet
146	10.7	+	180	13.8	1376	242	126.5	1374
147	10.8	+	181	13.9	1387	243	126.5	1385
148	10.9	+	182	14.0	1398	244	126.5	1396
149	11.0	+	183	14.1	1409	245	126.5	1407
150	11.1	+	184	14.2	1420	246	126.5	1418
151	11.2	+	185	14.3	1431	247	126.5	1429
152	11.3	+	186	14.4	1442	248	126.5	1440
153	11.4	+	187	14.5	1453	249	126.5	1451
154	11.5	+	188	14.6	1464	250	126.5	1462
155	11.6	+	189	14.7	1475	251	126.5	1473
156	11.7	+	190	14.8	1486	252	126.5	1484
157	11.8	+	191	14.9	1497	253	126.5	1495
158	11.9	+	192	15.0	1508	254	126.5	1506
159	12.0	+	193	15.1	1519	255	126.5	1517
160	12.1	+	194	15.2	1530	256	126.5	1528
161	12.2	+	195	15.3	1541	257	126.5	1539
162	12.3	+	196	15.4	1552	258	126.5	1550
163	12.4	+	197	15.5	1563	259	126.5	1561
164	12.5	+	198	15.6	1574	260	126.5	1572
165	12.6	+	199	15.7	1585	261	126.5	1583
166	12.7	+	200	15.8	1596	262	126.5	1594
167	12.8	+	201	15.9	1607	263	126.5	1605
168	12.9	+	202	16.0	1618	264	126.5	1616
169	13.0	+	203	16.1	1629	265	126.5	1627
170	13.1	+	204	16.2	1640	266	126.5	1638
171	13.2	+	205	16.3	1651	267	126.5	1649
172	13.3	+	206	16.4	1662	268	126.5	1660
173	13.4	+	207	16.5	1673	269	126.5	1671
174	13.5	+	208	16.6	1684	270	126.5	1682
175	13.6	+	209	16.7	1695	271	126.5	1693
176	13.7	+	210	16.8	1706	272	126.5	1704
177	13.8	+	211	16.9	1717	273	126.5	1715
178	13.9	+	212	17.0	1728	274	126.5	1726
179	14.0	+	213	17.1	1739	275	126.5	1737
180	14.1	+	214	17.2	1750	276	126.5	1748
181	14.2	+	215	17.3	1761	277	126.5	1759
182	14.3	+	216	17.4	1772	278	126.5	1770
183	14.4	+	217	17.5	1783	279	126.5	1781
184	14.5	+	218	17.6	1794	280	126.5	1792
185	14.6	+	219	17.7	1805	281	126.5	1803
186	14.7	+	220	17.8	1816	282	126.5	1814
187	14.8	+	221	17.9	1827	283	126.5	1825
188	14.9	+	222	18.0	1838	284	126.5	1836
189	15.0	+	223	18.1	1849	285	126.5	1847
190	15.1	+	224	18.2	1860	286	126.5	1858
191	15.2	+	225	18.3	1871	287	126.5	1869
192	15.3	+	226	18.4	1882	288	126.5	1880
193	15.4	+	227	18.5	1893	289	126.5	1891
194	15.5	+	228	18.6	1904	290	126.5	1902
195	15.6	+	229	18.7	1915	291	126.5	1913
196	15.7	+	230	18.8	1926	292	126.5	1924
197	15.8	+	231	18.9	1937	293	126.5	1935
198	15.9	+	232	19.0	1948	294	126.5	1946
199	16.0	+	233	19.1	1959	295	126.5	1957
200	16.1	+	234	19.2	1970	296	126.5	1968
201	16.2	+	235	19.3	1981	297	126.5	1979
202	16.3	+	236	19.4	1992	298	126.5	1990
203	16.4	+	237	19.5	2003	299	126.5	2001
204	16.5	+	238	19.6	2014	300	126.5	2012
205	16.6	+	239	19.7	2025	301	126.5	2023
206	16.7	+	240	19.8	2036	302	126.5	2034
207	16.8	+	241	19.9	2047	303	126.5	2045
208	16.9	+	242	20.0	2058	304	126.5	2056
209	17.0	+	243	20.1	2069	305	126.5	2067
210	17.1	+	244	20.2	2080	306	126.5	2078
211	17.2	+	245	20.3	2091	307	126.5	2089
212	17.3	+	246	20.4	2102	308	126.5	2100
213	17.4	+	247	20.5	2113	309	126.5	2111
214	17.5	+	248	20.6	2124	310	126.5	2122
215	17.6	+	249	20.7	2135	311	126.5	2133
216	17.7	+	250	20.8	2146	312	126.5	2144
217	17.8	+	251	20.9	2157	313	126.5	2155
218	17.9	+	252	21.0	2168	314	126.5	2166
219	18.0	+	253	21.1	2179	315	126.5	2177
220	18.1	+	254	21.2	2190	316	126.5	2188
221	18.2	+	255	21.3	2201	317	126.5	2199
222	18.3	+	256	21.4	2212	318	126.5	2210
223	18.4	+	257	21.5	2223	319	126.5	2221
224	18.5	+	258	21.6	2234	320	126.5	2232
225	18.6	+	259	21.7	2245	321	126.5	2243
226	18.7	+	260	21.8	2256	322	126.5	2254
227	18.8	+	261	21.9	2267	323	126.5	2265
228	18.9	+	262	22.0	2278	324	126.5	2276
229	19.0	+	263	22.1	2289	325	126.5	2287
230	19.1	+	264	22.2	2300	326	126.5	2298
231	19.2	+	265	22.3	2311	327	126.5	2309
232	19.3	+	266	22.4	2322	328	126.5	2320
233	19.4	+	267	22.5	2333	329	126.5	2331
234	19.5	+	268	22.6	2344	330	126.5	2342
235	19.6	+	269	22.7	2355	331	126.5	2353
236	19.7	+	270	22.8	2366	332	126.5	2364
237	19.8	+	271	22.9	2377	333	126.5	2375
238	19.9	+	272	23.0	2388	334	126.5	2386
239	20.0	+	273	23.1	2399	335	126.5	2397
240	20.1	+	274	23.2	2410	336	126.5	2408
241	20.2	+	275	23.3	2421	337	126.5	2419
242	20.3	+	276	23.4	2432	338	126.5	2430
243	20.4	+	277	23.5	2443	339	126.5	2441
244	20.5	+	278	23.6	2454	340	126.5	2452
245	20.6	+	279	23.7	2465	341	126.5	2463
246	20.7	+	280	23.8	2476	342	126.5	2474
247	20.8	+	281	23.9	2487	343	126.5	2485
248	20.9	+	282	24.0	2498	344	126.5	2496
249	21.0	+	283	24.1	2509	345	126.5	2507
250	21.1	+	284	24.2	2520	346	126.5	2518
251	21.2	+	285	24.3	2531	347	126.5	2529
252	21.3	+	286	24.4	2542	348	126.5	2540
253	21.4	+	287	24.5	2553	349	126.5	2551
254	21.5	+	288	24.6	2564	350	126.5	2562
255	21.6	+	289	24.7	2575	351	126.5	2573
256	21.7	+	290	24.8	2586	352	126.5	2584
257	21.8	+	291	24.9	2597	353	126.5	2595
258	21.9	+	292	25.0	2608	354	126.5	2606
259	22.0	+	293	25.1	2619	355	126.5	2617
260	22.1	+	294	25.2	2630	356	126.5	2628
261	22.2	+	295	25.3	2641	357	126.5	2639
262	22.3	+	296	25.4	2652	358	126.5	2650
263	22.4	+	297	25.5	2663	359	126.5	2661
264	22.5	+	298	25.6	2674	360	126.5	2672
265	22.6	+	299	25.7	2685	361	126.5	2683
266	22.7	+	300	25.8	2696	362	126.5	2694
267	22.8	+	301	25.9	2707	363	126.5	2705
268	22.9	+	302	26.0	2718	364	126.5	2716
269	23.0	+	303	26.1	2729	365	126.5	2727
270	23.1	+	304	26.2	2740	366	126.5	2738
271	23.2	+	305	26.3	2751	367	126.5	2749
272	23.3	+	306	26.4	2762	368	126.5	2760
273	23.4	+	307	26.5	2773	369	126.5	2771
274	23.5	+	308	26.6	2784	370	126.5	2782
275	23.6	+	309	26.7	2795	371	126.5	2793
276	23.7	+	310	26.8	2806	372	126.5	2804
277	23.8	+	311	26.9	2817	373	126.5	2815
278	23.9	+	312	27.0	2828	374	126.5	2826
279	24.0	+	313	27.1	2839	375	126.5	2837
280	24.1	+	314	27.2	2850	376	126.5	2848
281	24.2	+	315	27.3	2861	377	126.5	2859
282	24.3	+	316	27.4	2872	378	126.5	2870
283	24.4	+	317	27.5	2883	379	126.5	2881
284	24.5	+	318	27.6	2894	380	126.5	2892
285	24.6	+	319	27.7	2905	381	126.5	2903
286	24.7	+	320	27.8	2916	382	126.5	2914
287	24.8	+	321	27.9	2927	383	126.5	2925
288	24.9	+	322	28.0	2938	384	126.5	2936
289	25.0	+	323	28.1	2949	385	126.5	2947
290	25.1	+	324	28.2	2960	386	126.5	2958
291	25.2	+	325	28.3	2971	387	126.5	2969
292	25.3	+	326	28.4	2982	388	126.5	2980
293	25.4	+	327	28.5	2993	389	126.5	2991
294	25.5	+	328	28.6	3004	390	126.5	3002
295	25.6	+	329	28.7	3015	391	126.5	3013
296	25.7	+	330	28.8	3026	392	126.5	3024
297	25.8	+	331	28.9	3037	393	126.5	3035
298	25.9	+	332	29.0	3048	394	126.5	3046
299								



"Francis" Turbines

We are prepared to design and build for exact specifications for heads up to 500 feet. Capacity 40,000 horsepower. The scroll case shown in this engraving is a typical example of our work. Engraving 418 shows another example of a horizontal shaft scroll case.

Engraving No. 417



Engraving No. 418.

18-INCH WHEEL

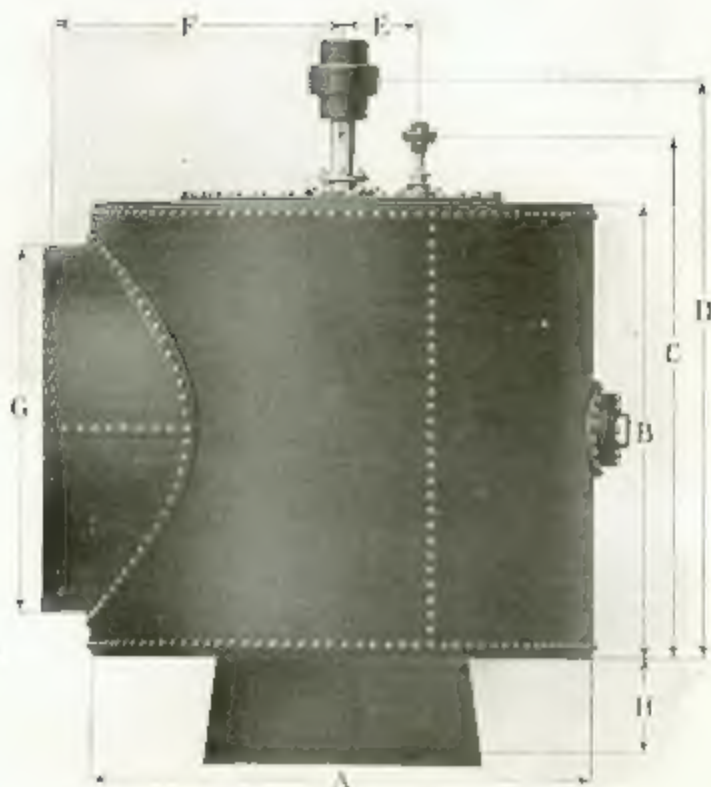
Head	Appachung per Minute	Discharge Cubic feet per Minute	Horse Power
1	1.1	8.8	1.1
2	2.2	17.6	2.2
3	3.3	26.4	3.3
4	4.4	35.2	4.4
5	5.5	44.0	5.5
6	6.6	52.8	6.6
7	7.7	61.6	7.7
8	8.8	70.4	8.8
9	9.9	79.2	9.9
10	11.0	88.0	11.0
11	12.1	96.8	12.1
12	13.2	105.6	13.2
13	14.3	114.4	14.3
14	15.4	123.2	15.4
15	16.5	132.0	16.5
16	17.6	140.8	17.6
17	18.7	149.6	18.7
18	19.8	158.4	19.8
19	20.9	167.2	20.9
20	22.0	176.0	22.0
21	23.1	184.8	23.1
22	24.2	193.6	24.2
23	25.3	202.4	25.3
24	26.4	211.2	26.4
25	27.5	220.0	27.5
26	28.6	228.8	28.6
27	29.7	237.6	29.7
28	30.8	246.4	30.8
29	31.9	255.2	31.9
30	33.0	264.0	33.0
31	34.1	272.8	34.1
32	35.2	281.6	35.2
33	36.3	290.4	36.3
34	37.4	299.2	37.4
35	38.5	308.0	38.5
36	39.6	316.8	39.6
37	40.7	325.6	40.7
38	41.8	334.4	41.8
39	42.9	343.2	42.9
40	44.0	352.0	44.0
41	45.1	360.8	45.1
42	46.2	369.6	46.2
43	47.3	378.4	47.3
44	48.4	387.2	48.4
45	49.5	396.0	49.5
46	50.6	404.8	50.6
47	51.7	413.6	51.7
48	52.8	422.4	52.8
49	53.9	431.2	53.9
50	55.0	440.0	55.0
51	56.1	448.8	56.1
52	57.2	457.6	57.2
53	58.3	466.4	58.3
54	59.4	475.2	59.4
55	60.5	484.0	60.5
56	61.6	492.8	61.6
57	62.7	501.6	62.7
58	63.8	510.4	63.8
59	64.9	519.2	64.9
60	66.0	528.0	66.0
61	67.1	536.8	67.1
62	68.2	545.6	68.2
63	69.3	554.4	69.3
64	70.4	563.2	70.4
65	71.5	572.0	71.5
66	72.6	580.8	72.6
67	73.7	589.6	73.7
68	74.8	598.4	74.8
69	75.9	607.2	75.9
70	77.0	616.0	77.0
71	78.1	624.8	78.1
72	79.2	633.6	79.2
73	80.3	642.4	80.3
74	81.4	651.2	81.4
75	82.5	660.0	82.5
76	83.6	668.8	83.6
77	84.7	677.6	84.7
78	85.8	686.4	85.8
79	86.9	695.2	86.9
80	88.0	704.0	88.0
81	89.1	712.8	89.1
82	90.2	721.6	90.2
83	91.3	730.4	91.3
84	92.4	739.2	92.4
85	93.5	748.0	93.5
86	94.6	756.8	94.6
87	95.7	765.6	95.7
88	96.8	774.4	96.8
89	97.9	783.2	97.9
90	99.0	792.0	99.0
91	100.1	800.8	100.1
92	101.2	809.6	101.2
93	102.3	818.4	102.3
94	103.4	827.2	103.4
95	104.5	836.0	104.5
96	105.6	844.8	105.6
97	106.7	853.6	106.7
98	107.8	862.4	107.8
99	108.9	871.2	108.9
100	110.0	880.0	110.0

21-INCH WHEEL

<i>Head</i>	<i>Penetration per Minute.</i>	<i>Discharge, Cubic feet per Minute.</i>	<i>Force Pump.</i>
5	137	1172	8.9
6	140	1283	11.0
7	162	1386	14.7
8	173	1482	17.9
9	184	1572	21.4
10	194	1657	25.0
11	203	1738	28.9
12	212	1815	32.9
13	221	1889	37.4
14	229	1960	41.5
15	237	2029	46.0
16	245	2096	50.7
17	253	2160	55.5
18	260	2223	60.5
19	267	2284	65.6
20	274	2343	70.8
21	281	2401	76.1
22	287	2457	81.7
23	294	2511	87.3
24	300	2567	93.1
25	306	2620	99.0
26	312	2672	105.0
27	318	2722	111.1
28	324	2772	117.3
29	330	2820	123.6
30	336	2870	130.1
31	341	2917	136.6
32	347	2961	143.3
33	352	3010	150.1
34	357	3055	157.0
35	362	3100	163.9
36	368	3144	171.0
37	373	3187	178.2
38	378	3230	185.5
39	384	3272	192.8
40	387	3314	200.3

42-INCH WHEEL

<i>Head.</i>	<i>Revolutions per Minute.</i>	<i>Discharge. Cubic feet per Minute.</i>	<i>Horse Power.</i>
5	67	4786	36.2
6	74	5242	47.5
7	80	5662	59.9
8	85	6053	73.2
9	90	6421	87.3
10	95	6768	102.3
11	100	7098	118.0
12	104	7411	134.4
13	108	7717	151.6
14	112	8008	169.4
15	116	8289	187.9
16	120	8561	207.0
17	124	8824	226.7
18	128	9080	247.0
19	131	9329	267.8
20	134	9571	289.3
21	138	9808	311.2
22	141	10038	333.7
23	144	10264	356.7
24	147	10485	380.2
25	150	10701	404.2
26	153	10913	428.7
27	156	11121	453.7
28	159	11325	479.1
29	162	11525	505.0
30	165	11722	531.4
31	167	11916	558.2
32	170	12107	585.4
33	173	12294	613.1
34	175	12479	641.1
35	178	12661	669.6
36	180	12841	698.5
37	183	13018	727.8
38	185	13193	757.5
39	188	13365	787.6
40	190	13536	818.1



Engraving No. 405.

The price of steel flumes usually exceeds the cost of those constructed from wood, but for many locations they are more desirable on account of their durability and freedom from leakage.

Each flume has a heavy cast iron top and bottom. The top is provided with a lid of sufficient size to admit the wheel and contains packing boxes for wheel and gate shafts.

A man door is conveniently located on the side of the flume affording easy access to the water wheel. See dimensions of flumes on page 37.

DIMENSIONS OF STEEL FLUMES IN INCHES

Lettered columns correspond with letters in Engraving No. 403

Diameter of Wheel	A	B	C	D	E	F	G	H
9	36	36		57½		24	24	6½
12	42	42		64½		27	30	7½
15	48	48		70½		30	36	9½
18	54	54	69½	76½		33	42	10½
21	60	60	75½	83		38	48	12½
24	72	70	85½	93	Dimensions given upon application	44	54	13½
27	84	76	91½	99		50	60	15½
30	90	82	97½	106½		53	66	16½
33	96	90	100½	119		56	72	18½
36	102	96	114½	128		59	78	21½
39	108	102	120½	128½		62	84	22½
42	114	108	126½	137½		65	90	25½
45	120	112	130½	142½		68	96	26½
48	126	114	132½	144½		71	96	28½
51	132	118	139½	152½		74	100	29½
54	144	122	144	156½		80	104	21½
57	156	126	148	161½		86	108	33½
60	168	132	154	167½		92	114	35
66	180	138	160	173½		98	120	41
72	200	162	184	197½		108	144	46½